pylorus and duodenum, and because patients subsequently suffer from digestive symptoms, the recurrence of the ulcer, and even the starting of new peptic ulcers in the intestine.

To summarize the medical treatment:

Attempt to secure a calm mind, a quiet nervous system, and improvement of the general health.

Make a positive diagnosis, begin treatment early, and carry it out with painstaking attention to details for a long time.

Obtain general rest. In some cases feed the patient sufficiently, but discretely; in others, starve the patient for a period, depending for support upon frequent, small enemas of normal salt solution.

For the control of hemorrhage, in addition to rest, one may succeed by local treatment through the stomach tube, using ice-water, or adrenalin solution, followed by gelatin water.

In irritating hyperacidity, one should use local general sedatives and antacids.

To relieve hypertension and spasm of the stomach, in addition to suitable drugs, use external applications according to von Leube, or the equivalent of these.

Finally, continue treatment long after apparent cure, and study the stools for occult blood; but we should also remember the dictum of Bettmann[8] that, "it is not alone the question of how long treated, but how well treated." Statistics mean little, because of the uncertainty of method and the faulty detail so often observed in the treatment of this disease.

STUDIES ON ARTERIOSCLEROSIS, WITH SPECIAL REFERENCE TO THE RADIAL ARTERY.

By W. S. Thayer, M.D.,
PROFESSOR OF CLINICAL MEDICINE, JOHNS HOPKINS UNIVERSITY,
AND
Marshal Fabyan, M.D.,
ASSISTANT IN PATHOLOGY, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND.

Among the first things which we record in the every-day examinaton of a patient is the palpability and consistency of the radial artery. While there has been much discussion as to what inferences one is justified in drawing with regard to the condition of the general arterial tree or of special central vessels, from the condition of the radial, we have, as a rule, little conception as to just what we are feeling in the radial artery itself.

In order to gain information upon this point one of us (Fabyan) over a year ago, undertook the study of the radial arteries from a series of consecutive cases which had been previously observed, clinically, in the wards of the hospital. At the same time, for the sake of comparison, there were removed from each case, bits of the aorta

---

[8] New York Med. Jour., March 9, 1907.

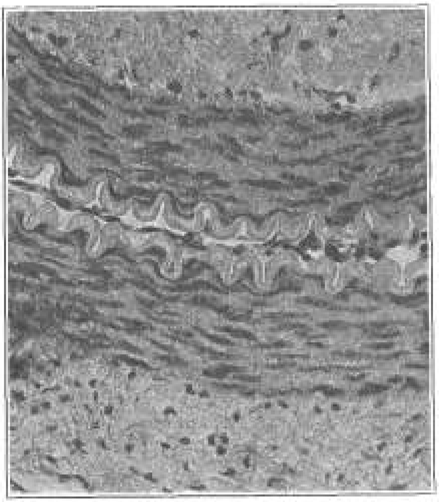

FIG. 1.—Radial artery of a seven months' child (Case 58) who died fifty-six days after birth of bronchopneumonia (hematoxylin and eosin). This artery was not palpable clinically.

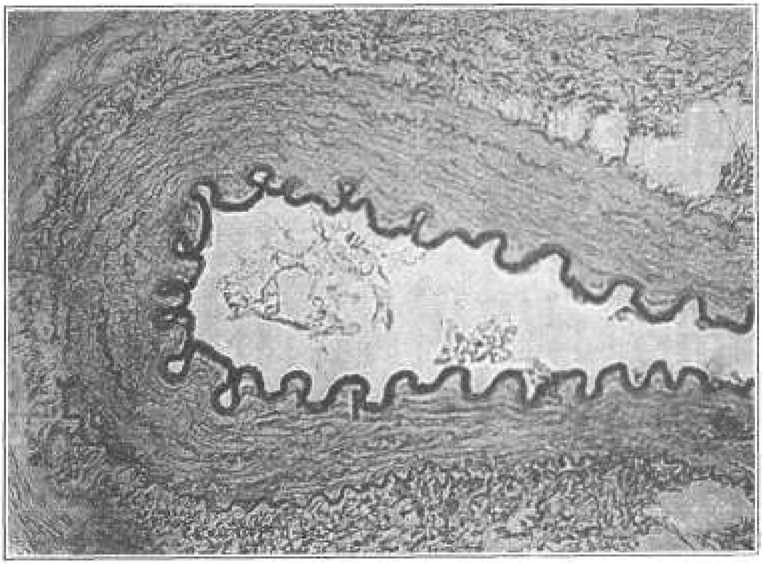

FIG. 2.—Radial artery of a seven months' child (Case 58) who died fifty-six days after birth of bronchopneumonia (Weigert's elastic tissue stain).

just above the valves and from a point just above the origin of the mesenteric artery, as well as a piece of the mesenteric vessel just below its point of origin.

The first question which we asked ourselves was: *What is the character of the normal radial artery and what are the common changes with which one meets?*

The material consisted of 61 cases, the ages of the patients varying from fifty-six days (in a seven months' child) to eighty-three years. We were immediately impressed with the fact that the radial artery varies greatly in its general characters at different ages.

At *birth* the artery is delicate, translucent, extremely thin, and collapsing. The surface on opening is perfectly smooth. The intima consists of a single endothelial layer, lying directly on the surface of a deeply undulating elastica interna. The media, which consists of transversely arranged, smooth muscle fibres with rather large vesicular nuclei, has a depth of about seven to eight layers of cells. Connective tissue, if present in the intima and media, is extremely scanty, none being revealed by the Mallory or van Gieson stains. There is, however, a relatively large amount of elastic tissue which appears on cross section as very thin, parallel, slightly wavy lines. The elastica externa is neither as coarse nor as deeply undulating as the interna (Figs. 1, 2, and 3).

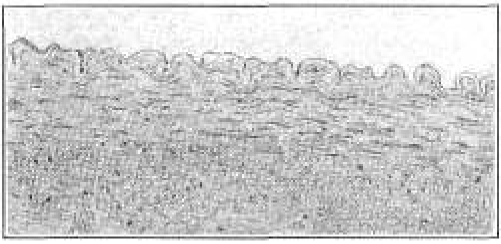

FIG. 3.—Radial artery of a child, aged two and half years (Case 15), who died of general spastic paralysis and bronchopneumonia. This artery was not palpable clinically.

The adventitia, considerably thicker than the media, consists of compact connective-tissue fibres with relatively large nuclei. The elastic fibres are fairly numerous, running in various directions.

The picture alters progressively with the age and growth of the individual. The changes are especially striking in the *intima* which, sometimes as early as the middle of the first decade (Figs. 4 and 5), becomes distinctly thickened. This thickening consists in the appearance, uniformly, or at local points in the intima, of a fresh strip of elastica which appears to be lifted up or split off from the surface of the interna. In specimens stained by Weigert's method the elastica interna takes a clear, grey-blue color. With growth and development the inner surface of the interna becomes irregular and roughened in outline and of a deep black hue. Gradually, the irregular, rough, deeply staining inner layer is at points lifted from the surface of the interna, forming a separate, more or less parallel

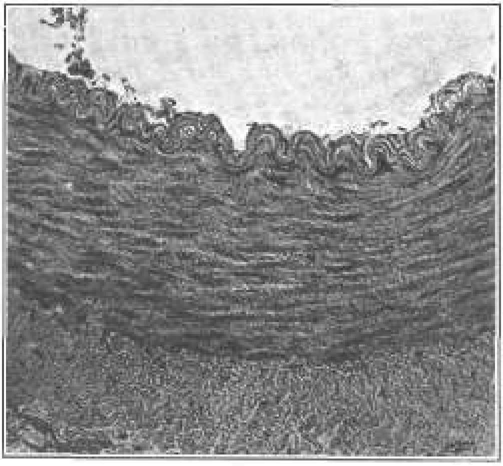

Fig. 4.—Radial artery of a child five years old (Case 61) who died of bronchopneumonia following measles (hematoxylin and eosin). This specimen shows a beginning elastic muscular thickening of the intima with the separation of a second layer of elastica from the surface of the intima. This artery was not palpable clinically.

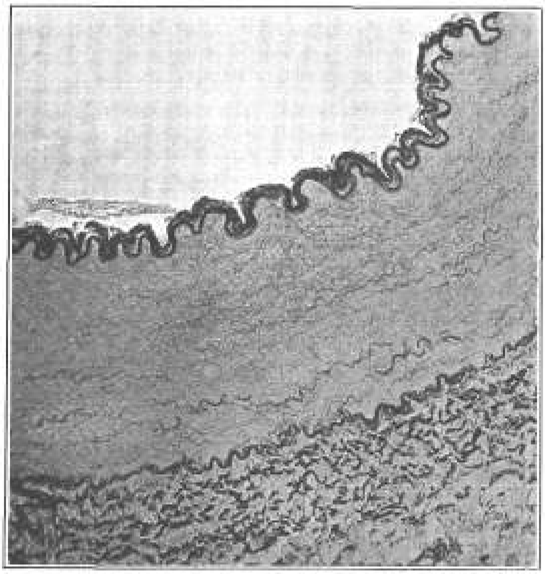

Fig. 5.—Radial artery of a child five years old (Case 61) who died of bronchopneumonia following measles (Weigert's elastic tissue stain). The specimen shows the early separation of an inner layer of elastica from the surfaces of the interna. This inner layer has at points a somewhat beaded appearance.

strand (Fig. 6). This strand on cross section appears beaded, and in longitudinal sections much smoother, justifying, in our opinion, the conclusions of Hallenberger,[1] that it represents a collection of longitudinal fibres. In some specimens, connective-tissue cells may be seen apparently making their way through the interstices of the fenestrated membrane, giving rise to the picture on which Hallenberger bases his hypothesis that ingrowth of connective tissue causes the separation of these inner layers of longitudinal elastic fibres. At the same time between these two layers, and sometimes between the inner layer and the endothelium there appear a few connective-tissue cells and smooth muscle fibres which have in the main a longitudinal course.

The *media* also increases in thickness with the growth of the individual. The elastica in this coat is very scanty in amount, merely an occasional thin wavy fibre. Just external to the elastica interna there may be a delicate layer of connective-tissue fibres.

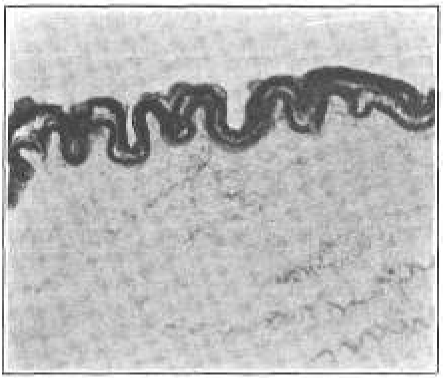

FIG. 6—Radial artery of a child five years old (Case 61) who died of bronchopneumonia following measles (Weigert's elastic tissue stain). The specimen shows the same changes noted in Fig. 5 under a higher power.

In the *second decade* the artery gradually assumes the character of the adult vessel; the walls become thicker but the vessel still lies collapsed like a ribbon on its muscular bed. The surface shows on section a number of delicate, transverse striations, as well as two longitudinal lines which correspond to the points at which the artery folds when in a state of collapse. The cause of the transverse striations is uncertain. Their appearance at the same time with the development of longitudinal elastic and muscular fibres in the intima, and the fact that they disappear when the artery is stretched, have suggested to us that they may be due to the contraction of these fibres.

---

[1] Ueber die Sklerose der Arteria radialis, Marburg, 1906, 8. This valuable communication did not appear until some time after the beginning of our studies, and was unknown to us until our work was nearly done. It is satisfactory to find that our observations are in most particulars confirmatory of Hallenberger's results.

The *intima* has increased materially in thickness. A second strip of elastica is usually present. More, longitudinally arranged, smooth muscle cells have appeared as well as a small number of connective-tissue cells.

The *media* is also thicker (Fig. 7), the elastic tissue being relatively less marked and not as uniformly dispersed as in the first decade. Delicate fibrils running in various planes seem to arise from the interna and externa. No connective tissue is demonstrable excepting a fine layer just external to the interna.

In one case in this decade, a boy with chronic nephritis, there were local areas in which the intima was slightly more thickened (observable only by the microscope). In these areas, beside the second strand of elastica, there was a meshwork of finer elastic fibrils with an appreciable increase in connective tissue. Outside these points the elastica interna seemed less wavy and appeared rather stretched.

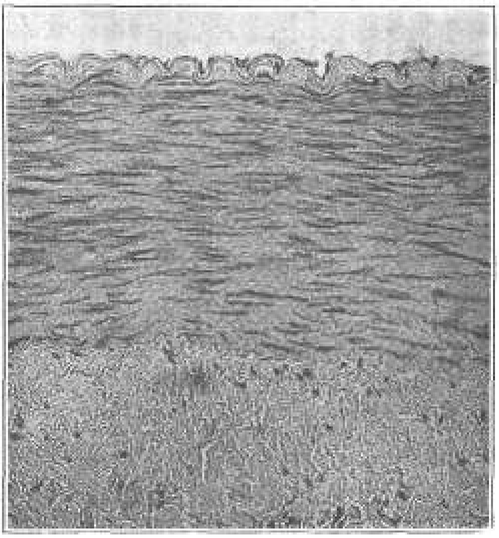

FIG. 7.—Radial artery of a girl, aged fourteen years (Case 35), who died of pneumonia and pericarditis (hematoxylin and eosin). The specimen shows early elastic muscular thickening of the intima. This artery was just palpable clinically, but was not regarded as thickened.

In the *third and fourth decades* there is no great change in the constitution of the vessel. The *gross appearance* of the artery when laid open is the same excepting that in a few cases an occasional longitudinal line of irregular length is to be noted. The significance of these is not entirely clear, but their association, as a rule, with the presence of microscopic areas of connective-tissue thickening of the intima which contain numerous fine elastic fibres has suggested to us that they may be due to irregularities in the contraction of the vessel associated with these changes.

The *intima* and *media* tend to become somewhat thicker. The intima always shows a second strand of elastica and in several instances as many as two or even three additional strands. In addition to these, sometimes in irregular patches, sometimes more or less uniformly, the larger strands are replaced by a meshwork of fine fibrils with a marked increase in connective tissue (Fig. 8). These areas of connective-tissue thickening are especially noticeable in the vessels of a laborer, aged twenty-two years (No. 37), who had been a very heavy worker; of a laborer, aged twenty-five years (No. 60), with chronic nephritis; of a man, aged thirty-one years (No. 48), with aortic insufficiency; of a sailor, aged thirty-five years (No. 33), with mitral and aortic insufficiency and dilated heart. In one of these cases, that of the man, aged twenty-two years, there was a spot of calcification in the deeper part of a marked connective-tissue thickening of the intima (Fig. 9).

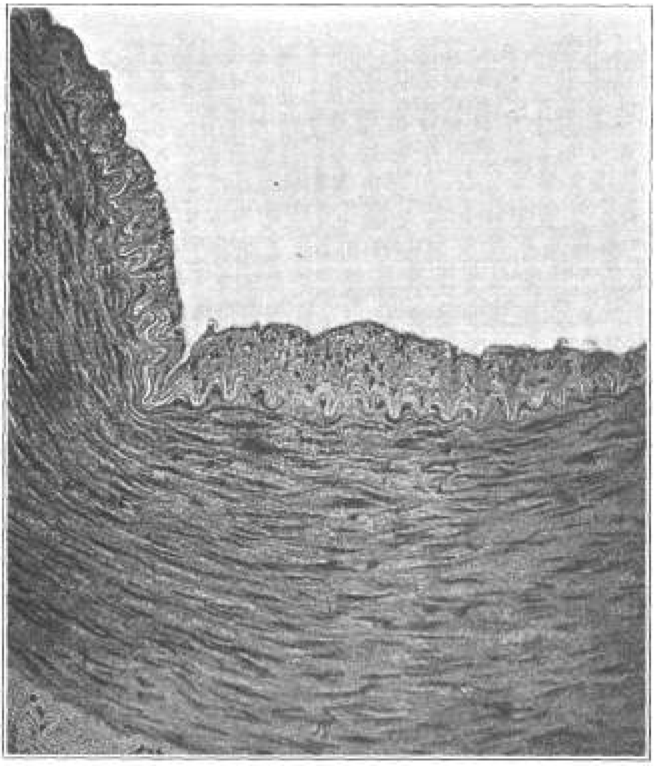

FIG. 8.—Radial artery of a healthy man, aged thirty-two years (Case 38), who died of a traumatic cerebral hemorrhage (hematoxylin and eosin). Elastic muscular thickening of the intima with a local sclerotic patch showing a fine elastic network. This artery was palpable clinically, but was *not regarded* as a thickened vessel.

The *media* becomes gradually somewhat thicker, and connective tissue begins to be demonstrable by van Gieson's stain. The connective tissue is always more marked just outside the elastica interna at points of local thickening of the interna.

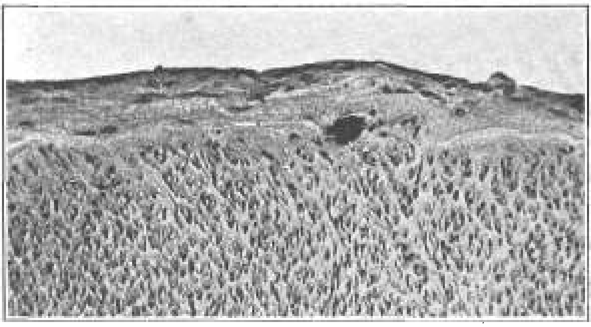

Fig. 9.—Radial artery of a day laborer, aged twenty-two years (Case 37), accustomed to heavy physical exercise, who died of pneumonia. Longitudinal section (hematoxylin and eosin). In the depths of the sclerotic intima is an area of calcification.

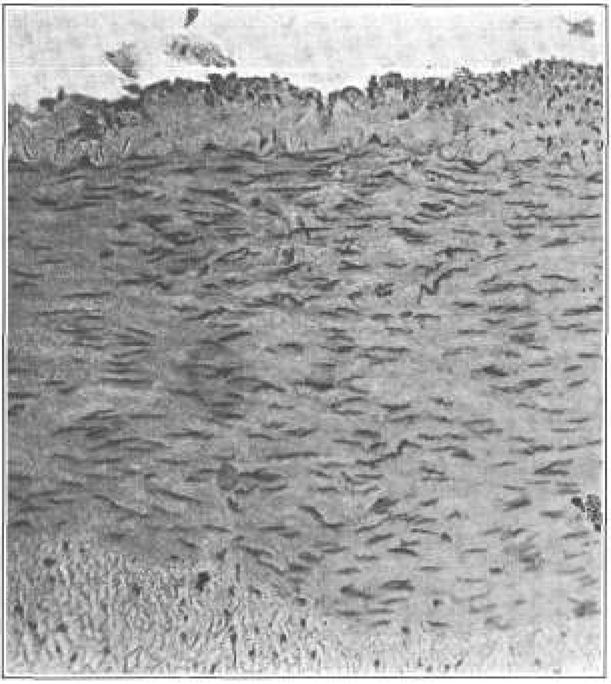

Fig. 10.—Radial artery of a day laborer, aged twenty-two years (Case 37), accustomed to heavy physical exercise, who died of pneumonia (hematoxylin and eosin). The specimen shows a local intimal thickening with increase of connective tissue and a fine network of elastic fibres. Marked thickening of the media. This artery was palpable clinically, but was not considered an unduly thickened vessel.

In several instances the media was, on measurement, considerably thicker than the average. Of these cases, 4 in number, 1 was a day laborer, aged twenty-two years (No. 37), who had been a very heavy worker. This patient also showed a very thick intima with a marked, fine, elastic meshwork and considerable connective tissue (Fig. 10).

The second was a laborer, aged twenty-five years (No. 60), an exceedingly heavy drinker and a heavy worker with chronic nephritis. In this case there was also a considerable thickening of the intima with the separation in some places of two strips of elastica and areas of greater connective-tissue thickening.

One was a man, aged twenty-seven years (No. 42), an exceedingly heavy drinker with an hypertrophied heart. Here the intima, though not very thick, showed the separation of one strip of elastica with small areas of irregular thickening with fine elastic meshwork.

The fourth case was a man, aged thirty-one years (No. 48), with aortic insufficiency; this man had been also a very heavy worker. The intima showed areas of local connective-tissue thickening with a fine, irregular, elastic meshwork. It may be noted that 3 of these 4 cases were also among those selected as examples of especial thickening of the intima.

In the *fifth decade* a decided change occurs. The lumen of the vessel as viewed in gross, remains open and irregularities in the wall may be felt on palpation. In cases which are especially thickened the transverse striations have disappeared and longitudinal lines of varying length are to be noted. In no case are there raised plaques. Plaques are, however, represented by slight cuppings about 3 to 4 mm. in length and about 2 mm. in breadth. Their surface is perfectly smooth; they are usually rather less circumscribed than those observed, for instance, in the coronary artery and of grayer color. Not infrequently these areas show calcification.

The *intima* has become diffusely thickened and begins to contain considerable connective tissue (Figs. 11 to 14). In a number of cases further strands of elastica appear to have separated off from the interna, sometimes as many as three. The areas with connective-tissue thickening and a diffuse fine meshwork of elastic fibres are more numerous. In some of these areas the elastica interna can no longer be distinguished as a separate layer (Fig. 12).

In 6 out of 19 cases in this decade there were areas of calcification in the deep layers of the intima. The tissue about these areas is homogeneous, nearly free from nuclei and takes usually a rather deep, eosin stain. The elastica interna, externally to the calcified spots, is usually stretched and may appear to be broken; it may, apparently, have entirely disappeared.

In 1 case, a man, aged forty years, there was evident bone formation extending from the intima through the destroyed elastica into the media.

The *media* in this decade reaches its maximum average thickness, but the increase from the last decade is, relatively, considerably less than that of the intima. Opposite the thicker plaques in the intima the media is often considerably thinned, the nuclei elongated

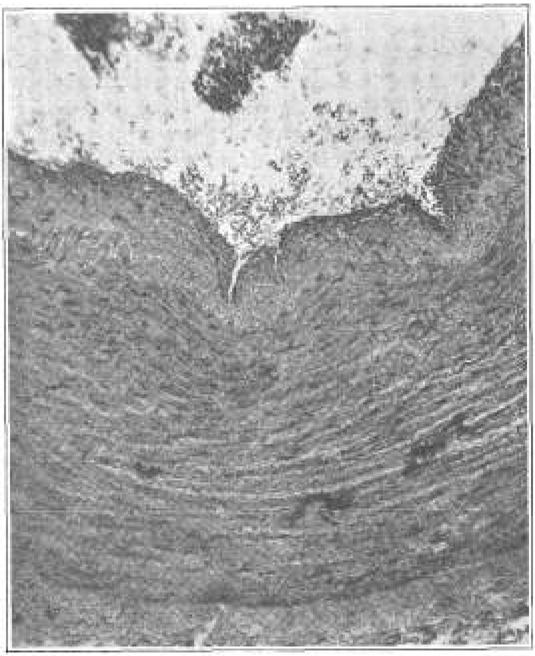

FIG. 11.—Radial artery of a day laborer, aged forty-one years (Case 54), who died of aortic insufficiency and pericarditis (hematoxylin and eosin). Diffuse sclerosis of the intima. This artery was regarded clinically as a thickened vessel.

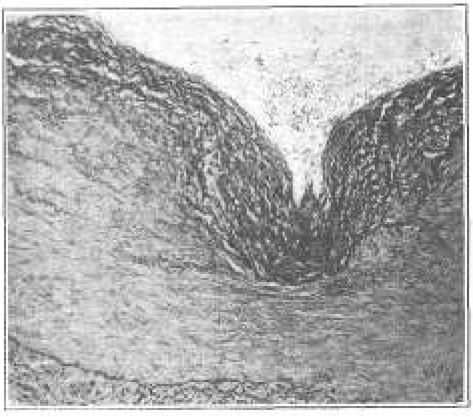

FIG. 12.—Radial artery of a day laborer, aged forty-one years (Case 54), who died of aortic insufficiency and acute pericarditis (Weigert's elastic tissue stain). Diffuse sclerosis of the intima. The elastica interna has disappeared. Meshwork of fine elastic fibres throughout the intima.

narrowed, and diminished in number; there is a good deal of connective tissue. In 3 of those cases in which calcification was noted in the intima there was also a medial calcification, most marked in the inner part of the coat, close to the elastica interna, opposite the points of intimal calcification. In 1 instance it was very extensive, involving nearly the whole width of the coat in places, producing a picture similar to that described by Mönckeberg.[2] One can sometimes trace the deposition of lime salts directly into muscle cells from which the nuclei have disappeared, while in the periphery of these areas there may be evident hypertrophy of the individual muscle fibers. The tissue about the calci-

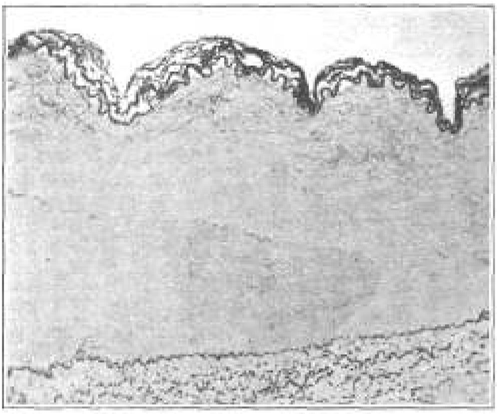

Fig. 13.—Radial artery of a day laborer, aged forty-two years (Case 44), who died of chronic nephritis (Weigert's elastic tissue stain). At points there are multiple strands of elastica. At other points there is a fine elastic network. In places the interna seems thinned and stretched. This artery was regarded clinically as a thickened vessel.

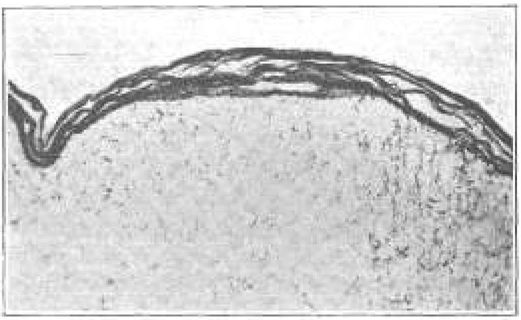

Fig. 14.—Radial artery of a day laborer, aged forty-two years (Case 44), who died of chronic nephritis (Weigert's elastic tissue stain.) Longitudinal section shows multiple strands of elastica in the intima.

---

[2] Ueber die reine Mediaverkalkung der Extremitätenarterien und ihr Verhalten zur Arteriosklerose; Arch. f. pathol. Anat. u. Physiol. u. f. klin. Med., 1903, Band clxxi, 141.

fied areas has sometimes a homogeneous appearance staining with eosin, while the nuclei have disappeared.

The elastic tissue in the media is scanty—merely a few thin, straight fibres parallel, in cross sections, to the lumen. In this

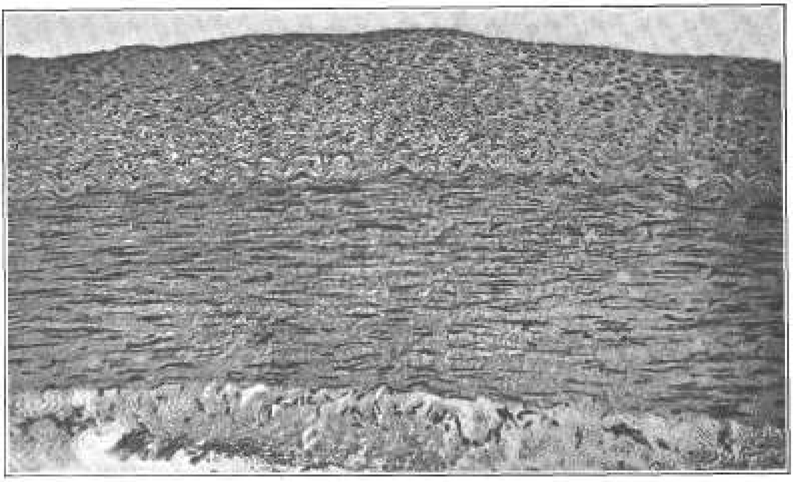

FIG. 15.—Radial artery of a tailor, aged sixty-four years (Case 49), with chronic nephritis and hypertrophied heart, who died of an œsophageal carcinoma (hematoxylin and eosin). Diffuse sclerosis of the intima. Clinically this artery was palpable and regarded as a thickened vessel.

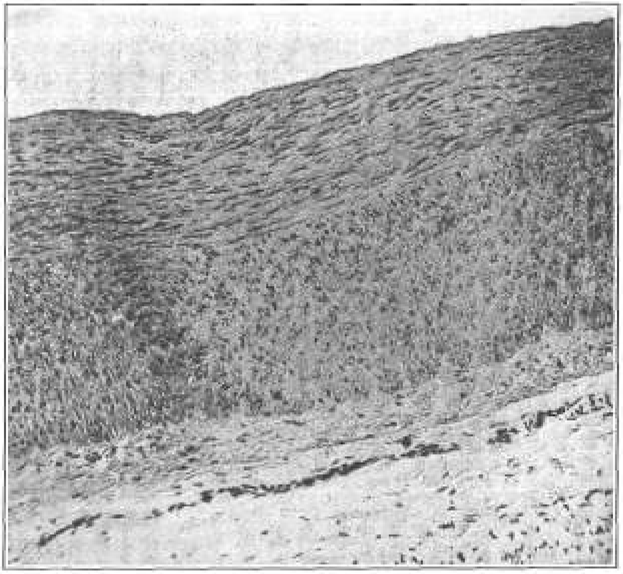

FIG. 16.—Radial artery of a tailor, aged sixty-four years (Case 49), with chronic nephritis and hypertrophied heart, who died of œsophageal carcinoma. Longitudinal section (hematoxylin and eosin). Diffuse sclerosis of the intima.

decade there were 6 cases in which the media was especially thickened. Of these, 3 were instances of chronic nephritis, 1 of aortic insufficiency, and 2 occurred in individuals who had been extremely heavy workers and alcoholics.

After the fifth decade there is a progressive increase in the thickness of the intima. From one to three, more or less regular elastic strips may be split off from the interna, but with advancing years these are less marked and a diffuse connective-tissue thickening of the intima with fine, irregular, elastic fibres becomes the common type (Figs. 15 and 16). Calcification in the deep layers of the intima (Fig. 17) becomes commoner with age, 4 out of 5 cases in the eighth and ninth decade showing this change.

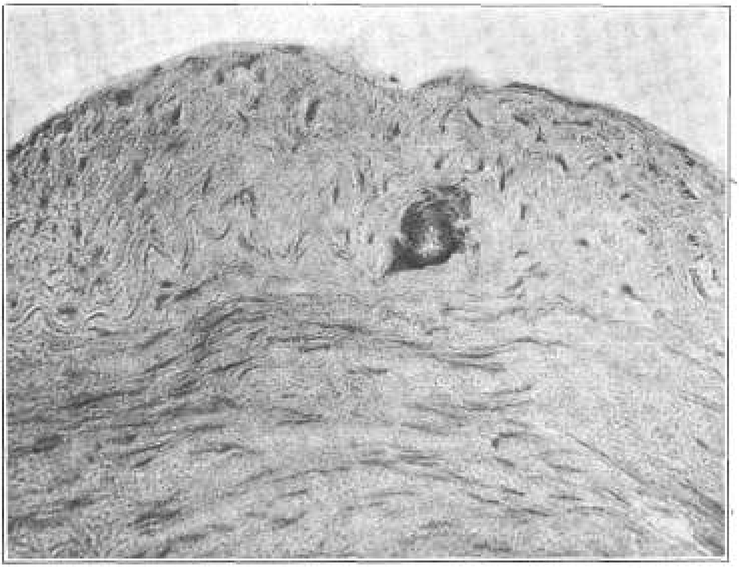

FIG. 17.—Radial artery of a carpenter aged sixty-six years (Case 50), with carcinoma of the stomach, who died of acute peritonitis; high power (hematoxylin and eosin). Calcified area in a sclerotic intima. This artery was clinically a thickened, beaded vessel.

The *media* after the fifth decade becomes, on the whole, rather thinner; there is a marked increase in the connective tissue and the tendency to calcification is greater. Opposite points of especial intimal thickening the media may be much thinned and evidently stretched, while the muscle fibres have in great part disappeared, having given way to connective tissue. The elastica interna in such cases is either much stretched or absent (Fig. 18). In some instances, as shown in the photograph of the artery of a man, aged eighty-three years, the whole vessel may be changed into an irregular, nodular tube (Fig. 19).

It thus becomes clear as pointed out by Jores[3] from a general standpoint, and by Aschoff,[4] and Hallenberger,[5] with regard to the radial especially, that an elastic muscular thickening of the intima appears in the radial artery at a relatively early age, that is, within

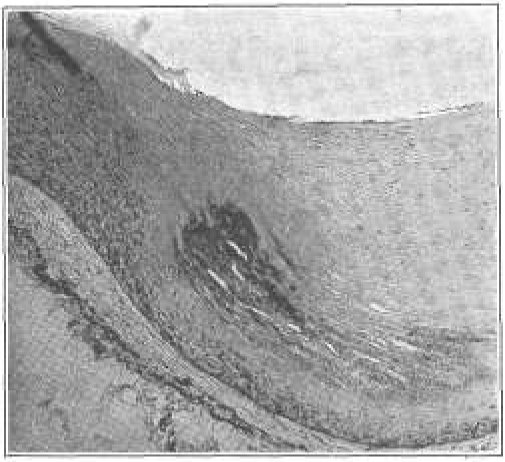

FIG. 18.—Radial artery of a blacksmith, aged seventy years (Case 52), a syphilitic, with chronic fibrous myocarditis, chronic mitral and tricuspid endocarditis and hypertrophy and dilatation of the heart, who died of pneumonia (hematoxylin and eosin). Extensive sclerotic plaque of intima with calcification. Widespread sclerosis of media which opposite the plaque is much thinned and stretched. Clinically this was a thickened vessel.

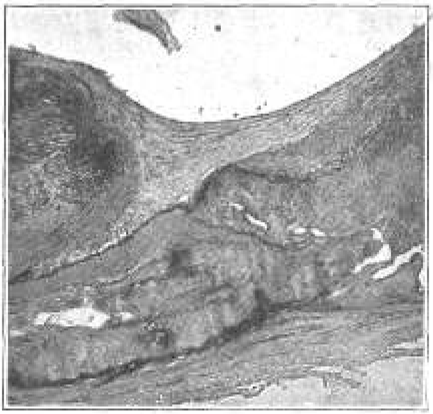

FIG. 19.—Radial artery of a farmer, aged eighty-three years (Case 1), with chronic nephritis and hypertrophied heart, who died of bronchopneumonia (hematoxylin and eosin). Extensive calcification of the intima and media. Clinically this vessel was hard and nodular.

---

[3] Wesen und Entwickelung der Arteriosklerose, Wiesbaden, 1903, 8.

[4] Sitzungsberichte der Gesell. zur Beförderung der gesammten Naturwissenschaften zu Marburg, 1905, Nr. 8, 117.

[5] Op. cit.

the first decade. With growth and the associated increase in pressure the artery strengthens itself—in the *intima* by the separation of one or more fresh strands of elastica from the inner surface of the fenestrated memberane, and the appearance about these of a few connective-tissue cells and longitudinal muscle fibres; in the *media* and *adventitia* by a gradual hypertrophy and hyperplasia. After full growth has been reached, at the end of the second decade, there is little change in the thickness of the adventitia. The intima, however, tends to become slightly thicker from the development of more elastic tissue and smooth muscle fibres, while the depth of the muscular media shows a slight increase. Gradually, however, during the third and fourth decades, especially in individuals subjected to heavy physical strain, there appear areas in the intima in which there is a distinct, connective-tissue thickening; the regular elastic strands which are separated from the interna are replaced by numerous, finer, more irregular fibrils, while on the outer side of the elastica, a delicate layer of connective tissue also appears. Opposite these areas the elastica interna is less deeply undulating and seems somewhat stretched, while connective tissue begins to appear between the muscle fibres of the media. *In other words, the strain has begun to tell upon the vessel wall, and the yielding tube fortifies itself by the connective-tissue thickening of the intima and to a lesser extent of the media.* As Aschoff has well expressed it, the artery of the child and that of the young adult with its increased amount of elastic tissue has a low, elastic resistance but a high limit of elasticity. Gradually, with the wear and tear of age or as the result of unusual and excessive strain, the elastic resistance becomes unequal to the burden imposed upon it and the limit of elasticity tends to be passed. The giving vessel then strengthens itself with a substance which has a much higher elastic resistance, but a lower limit of elasticity, namely, connective tissue.

But these changes are not marked until the fifth decade when the arte y begins to assume an essentially different appearance. The vessel wall, unable to stand the strain, tends to stretch, and an additional support is offered by the development of firm, connective tissue in the intima, together with an increase in that upon the medial side of the interna and, in lesser degree, throughout the media. The vessel is here usually felt as a firm tube.

Finally, in these sclerotic vessels, degenerative changes set in, which are somewhat different from those seen in the larger arteries, consisting as they do, of local areas of coagulation necrosis with calcification, especially marked in the deep layers of the connective tissue thickenings of the intima and in the muscle fibres of the media, particularly opposite these points. These changes may, as has been pointed out by Mönckeberg, go on to actual bone formation. Although, in one instance, there was an apparent atheromatous softening in the sclerotic intima of a man, aged seventy years, in not one of our cases did we see the superficial proliferation so common with fatty changes in the aorta.

When these facts are considered it becomes evident that it may often be difficult to draw a sharp line between the normal and the pathological radial artery. That which is normal at 50, would be pathological at 30 years. A connective-tissue thickening of the intima is not to be regarded as pathological in old age.

Regressive changes, necrosis, calcification, and atheroma which, as Jores has pointed out, occur especially, if not only, in a sclerotic intima, must be regarded as pathological.

It is a striking fact that in not one of our cases did we see calcification of the media unaccompanied by similar changes in the intima.

Is the normal radial artery ever palpable? To this question there can, of course, be but one answer. In the great majority of these cases, after the age of twenty years, the radial artery was palpable. Recognizing the fact, however, that if one rolls the artery carefully against the bone the normal vessel is often palpable, we divided our cases, clinically, into those which were not palpable or palpable and not regarded as thickened, and in which the vessel appeared to be distinctly thickened. When we compared our clinical notes with our pathological observations the result was extremely interesting. In the first and second decades none of the arteries were considered as thickened; in the third and fourth decades 77 per cent. were regarded as essentially normal, but in the fifth decade, at exactly that period when the connective-tissue thickening of the intima becomes especially marked, it appears that 63 per cent. of the arteries were regarded, clinically, as thickened vessels.

The arteries which were regarded clinically as thickened showed, in the majority of cases, anatomical thickening of the intima.

The beaded, goose-necked artery corresponded in practically every case to calcification of the intima or of intima and media.

It was our impression that the great frequency of the palpability of the arteries might be due in part to the fact that the majority of our patients were colored. But an analysis of our tables seems to show that, while the frequency of palpable arteries is indisputably somewhat greater among the colored, the difference is by no means as marked as we had fancied that it would be. The observations of one of us (Thayer) show clearly that the percentage of palpability of the radials in this group of hospital patients was much higher than that in healthy individuals in higher walks of life.

A study of the individual cases shows that, as a rule, the thickened vessel becomes evident to the palpating hand. There are, of course, striking individual exceptions, especially in very fat people. The palpability of the vessel depends apparently on the general thickening of the coats, especially, however, upon the changes in the intima which are progressive throughout life. In cases of aortic insufficiency and in chronic nephritis in which measurements show a considerable thickening of the media as well, this doubtless plays a part in the palpability of the vessel, but according to our measurements and tables the part is subordinate. It is a striking fact, moreover, that the thickening of the intima and the media go usually hand in hand. An analysis of our tables shows that in those cases in which heart hypertrophy was found, the media and intima were almost uniformly thicker than the average, and selecting from these cases those in which aortic insufficiency or chronic nephritis was present, the thickening of both coats appeared, on the whole, yet, more marked, but *it was rather striking that the change was more noticeable on the whole in the intima than in the media.* The same observations are true of those cases in which especially high pressure was noted *intra vitam.*

Comparison of the changes in the radial with those in the mesenteric artery and aorta.

The structure of the *mesenteric artery* is in some ways different from that of the radial.

In *gross,* the appearances are much the same but on a larger scale. The same transverse striations are visible in the opened vessel of the young adult, and the irregular, longitudinal lines are present in the more thickened artery. The *elastica interna* is a much thicker band. The *media* contains much more elastic tissue which is arranged as a well-marked meshwork. In areas throughout the muscular coat there are conspicuous aggregations of these fibres. The *adventitia* is very much thicker and contains more elastic tissue than that in the radial artery; this tends to have a longitudinal course (Figs. 19 and 20).

The changes in the intima and media are in the main identical with those in the radial. The same elastic, muscular intima develops early in life and the same connective-tissue thickening in the later decades. Here, also, the change from elastic muscular to connective-tissue thickening begins to be specially noticeable in the fifth decade.

Two points, however, are striking in the mesenteric arteries which have been examined, namely: (1) Calcification is apparently much less frequent than in the radials. (2) In several cases plaques were seen with fatty softening of the deeper layers of the intima and superficial proliferation—a picture which we have never seen in the radial.

In the *aorta,* as pointed out by Jores, the elastic-muscular intima

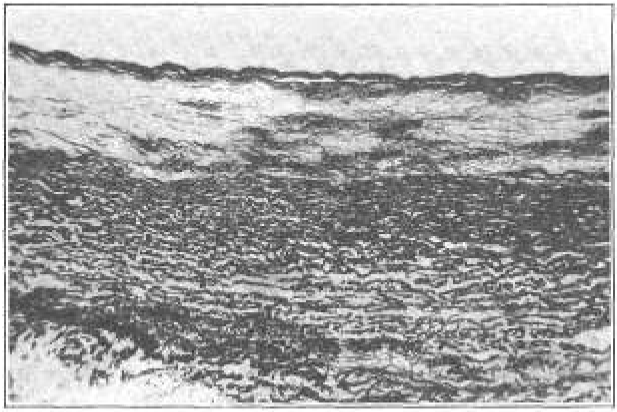

FIG. 20.—Mesenteric artery of a child, aged five years (Case 61), who died of bronchopneumonia following measles (Weigert's elastic tissue stain). The specimen shows the different arrangement of the elastic tissue from that seen in the radial artery. A second strand of elastic tissue has been separated from the surface of the interna.

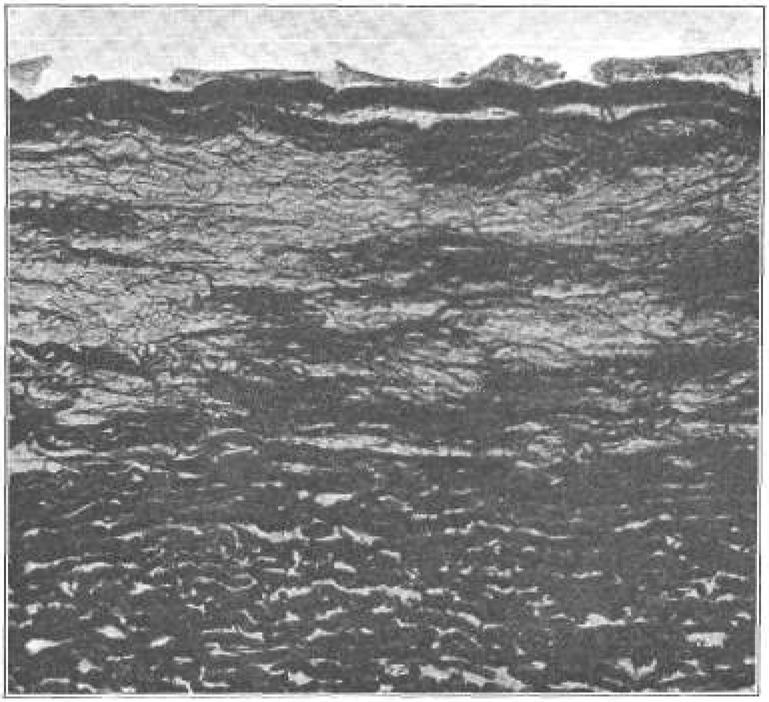

FIG. 21.—Radial artery of a child, aged five years (Case 61), who died of bronchopneumonia following measles (Weigert's elastic tissue stain). Shows the same conditions as Fig. 20, but under a higher power.

thickens progressively with age. This is beautifully borne out by Fabyan's measurements. Indeed, our tables, showing the thickness of the intima of the radial and the mesenteric arteries and the aorta, side by side, show a striking, progressive increase in the depth of the intima from birth to old age in all vessels, with the onset of connective-tissue sclerosis especially notable in the fifth decade. The disposition of the elastica in the aortic intima is much less regular than in the other vessels. The regressive changes, commoner in the thicker intimas, are particularly prone to be in the form of necrosis with fatty change and softening (atheroma) associated with active proliferation of the intima on the surface of the plaque.

In the aorta and mesenteric artery likewise over-strain and high pressure appear to result in changes analogous and more or less parallel to those in the radials. There are exceptions in individual cases which are sometimes striking. But, on the whole, when one finds an undue thickening of the intima in the radial, analogous changes are usually found in the mesenteric artery and aorta.

What inferences, then, are we justified in drawing from the presence of a thickened radial artery?

In old age a thickened radial artery represents conditions which are normal and to be expected, not only in peripheral, but in central vessels.

An unduly thickened radial at an earlier age may mean one of two things:

1. The vessel has been subjected to unusual and exceptional strain, or

2. It is a vessel which, from inherent weakness or other individual circumstances, has been unable to cope with conditions which might ordinarily be regarded as normal.

In either case the result has been the same; the artery has been obliged to fortify itself by progressive thickening of its walls, especially by a connective-tissue sclerosis of the intima and media.

As a rule, although there are striking individual exceptions, when the thickening of a radial artery is *unduly* marked, similar changes occur in the intima of the mesenteric artery and aorta. The early sclerosis of the intima, associated as it commonly is with like alterations in the muscular coat, constitutes a predisposition to those regressive changes (calcification, atheroma) which may be dangerous in other parts of the body. The distribution of such changes is irregular and too often not to be determined *intra vitam*, but the unduly palpable radial artery indicates a strong possibility of their existence in some part of the body at least, and may thus reasonably be regarded as a signal of danger.